

Progress Report on Funded Nursery Projects Washington State Department of Agriculture

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Project Title: Management of *Phytophthora ramorum* on conifer nursery stock

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Progress: Fungicides are often used to manage *Phytophthora* diseases on a variety of agricultural and nursery crops. In an effort to provide growers with information on the potential effectiveness of fungicides that could be used to protect conifers from *P. ramorum*, a cooperative project involving WSU and OSU was initiated in 2003. The following is a summary of the progress that has been made on this project.

Effect of fungicides on mycelial growth and zoospore germination: A series of studies were conducted to determine the effect of 20 fungicides on the growth of mycelia and the germination of zoospores from three Oregon A2 isolates of *P. ramorum*. These studies indicate that a number of fungicides were very effective in inhibiting *P. ramorum* mycelial growth and zoospore germination. This included systemic materials like Stature as well as contacts like Maneb. Mycelial growth was much more sensitive to some fungicides than were spores (e. g. Subdue MAXX), while spore germination was more affected than mycelial growth with others (e.g. Daconil Ultrex).

In addition, several fungicides such as Chipco Signature and Phostrol, which are generally not effective in the types of laboratory tests we conducted, can provide excellent control of various *Phytophthora* diseases under field and nursery conditions. Therefore, it is likely that some of these materials will also be effective in controlling *P. ramorum*.

Protection of seedlings from *P. ramorum*: The effectiveness of 20 systemic and contact fungicides in protecting Douglas-fir seedlings from infection by *Phytophthora ramorum* was determined in a series of three experiments. Some systemic products were applied about a week prior to bud break, while most treatments were applied just after bud break. One day after the post-bud break treatment applications, all the seedlings were inoculated by spraying them with zoospore suspensions obtained from isolates of A1 and A2 mating types of *P. ramorum*. Inoculated seedlings were then incubated under optimal conditions for disease development.

The only pre-bud break treatment that completely prevented infection was the drench application of Subdue MAXX. Pre-bud break drench applications of Stature, Insignia, and Terrazole had no affect on the number of infected seedlings. The reduction in infection by the pre-bud break applications of Heritage and Chipco Signature was variable and applications of Phostrol reduced infections by 71 to 75%.

Post-bud break applications of the contact fungicides Dithane, Gavel, Maneb, and Polyram provided 100% control. Although not as consistently effective, applications of Champ Formula 2F, Reason, Daconil Ultrex, Stature, and IKF – 916 reduced the number of infected seedlings by 70 to 100%. Most of the other fungicides included in these tests provided more limited or variable reductions in the number of infected seedlings.

The results of these tests indicate that a number of fungicides have the potential to provide excellent control of *P. ramorum* on Douglas-fir. This includes pre-bud break drench applications of the systemic fungicide Subdue MAXX and post-bud break foliar applications of several common "contact" types of fungicide.

Surfactant studies: Various wetting agents or surfactants have been used in some plant production systems to kill zoospores and control the spread of diseases caused by various *Pythium* and *Phytophthora* spp. Studies with two wetting agents indicate that post-bud break applications of the organosilicone surfactant, Silwet L-77, had no effect on infection of Douglas-fir seedlings by *P. ramorum*. However, post-bud break application of Latron CS-7 one day prior to inoculation completely prevented infection in 3 tests. In two other tests, Latron reduced infection by 43 to 67%. Additional studies are needed to determine if the differences in effectiveness of the Latron were due to differences in inoculum concentration or some other factor. Preliminary spore germination studies indicated that zoospore germination on glass slides that had been sprayed with Latron was reduced by about 73% compared to germination on untreated glass slides.

Residual activity of fungicides: Two experiments were conducted where Subdue MAXX, Dithane, Gavel, Polyram, Daconil Ultrex, and Phostrol were applied at various intervals (2 days to 8 weeks) prior to inoculation of Douglas-fir container-grown seedlings with A1 and A2 mating types of *P. ramorum*. Drench applications of Subdue MAXX (2 oz product/100 gallons) resulted in yellowing of the seedlings when 5 ml was applied per seedling. No phytotoxicity was observed when a 3 ml aliquot of a 1 oz product per 100 gallon solution was applied per seedling. In both trials, insufficient infection occurred on the inoculated checks to assess the residual effectiveness of any of the fungicide treatments. The reasons for the lack of infection are unknown at this time.

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